longer periods of time.[2]

2. Earnings Sharing Mechanism

A second method by which the productivity offset and recent past performance can be inappropriately linked is through the earnings sharing and lower formula adjustment mechanisms, such as currently included in the Commission's price cap plan for LECs. Under an earnings sharing mechanism, prices are adjusted downward on the basis of a firm's prior-year earnings so that the firm can keep only a small fraction of its efficiency gains. Under the current LEC price cap plan, increases in earnings result in the firm having to give up half (in the "50/50 sharing zone") or all of the earnings beyond certain limits. Thus, the sharing mechanism ties the regulated firm's future earnings to its recent past productivity performance, severely diluting efficiency incentives. Therefore, the earnings sharing mechanism should be eliminated from price cap regulation.

Conversely, the lower formula adjustment mechanism allows a LEC to adjust prices upward to target to the low-end earnings mark without extensive cost support. This mechanism skews efficiency incentives because it mitigates risks of poor earnings performance. To establish proper efficiency incentives, and to maintain symmetry, the lower formula adjustment mechanism should also be eliminated or changed significantly at the same time the earnings sharing mechanism is eliminated.

3. Company- or Region-Specific Productivity Offsets

A third way to inappropriately incorporate recent productivity performance into the productivity offset is to adopt company/region-specific productivity offsets for individual firms. The arguments proposed by some in favor of such an approach generally are based on the fact that individual companies are (1) at different stages of deployment of new technologies and operational efficiencies, and (2) experience different rates of productivity growth at any single point in time. The first point, different stages of technological deployment and operational efficiencies, results in differences among firms that relate primarily to transitory differences in current levels of costs, rather than to the capacity for productivity gains. Cost differences that have arisen under rate of return regulation as a result of company decisions to adopt or delay new technologies and other productivity enhancing measures are appropriately reflected in the different levels and structures of the LECs' initial prices at implementation of the price cap plan.

The second point, experiencing different rates of productivity growth at any single point in time, is primarily a reflection of the volatility in productivity gains over time. The fact that a firm may have been more productive than the industry over some short time period is not necessarily an indication that the firm will be able to sustain higher growth into the future. In fact, it may be increasingly more difficult for an efficient provider to increase productivity growth, because the firm is already deploying state-of-the-art technology and production processes. Recall that

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[2] Strategic Policy Research, Inc., "Regulatory Reform for the Information Age: Providing the Vision," January 11, 1994, pp. 17-21.

the productivity offset measures the rate of change in efficiency, not the level of efficiency. Thus, incremental gains in productivity growth may be incrementally much harder to achieve. Conversely, a firm that has lagged industry productivity growth in the past will not necessarily continue to lag behind in the future as it tries to catch up with the market and implements efficiency enhancing improvements.

To emulate a competitive market outcome, the appropriate productivity yardstick for price cap regulation should be a sufficiently broad measure, such as an industry-wide productivity index. Specifically, the productivity offset should represent a target that is based on the underlying productivity growth potential of the industry so that it is unaffected by an individual firm's performance. Ensuring that the productivity offset is unaffected by a firm's actual performance improves the firm's incentives to become more productive.[3]

Incentives to innovate and increase efficiency will be greatest if the productivity offset is at least as broad as an industry-wide LEC productivity index. Since carriers can make a positive contribution towards increasing earnings if they can achieve greater productivity gains than those reflected by the productivity offset, carriers have an incentive to be more productive than the industry as a whole. To achieve this, carriers must consider expected productivity impacts on all their business decisions and select projects and investments with the greatest productivity potential. Carriers that exceed industry-wide productivity have an incentive to become even more productive, because the more an individual firm can surpass the industry norm, the greater its earnings potential. LECs that fall short of the industry productivity index will likely see their earnings erode and have strong incentives to strive to become at least as, and more, productive than the industry as a whole. Thus, it is the ability to realize all earnings (i.e., retain earnings above the productivity offset restraint) that drives a firm in a pure price cap plan to redeploy resources in the most efficient manner.[4]

Use of an industry-wide productivity offset is consistent with the workings of a competitive market, which is a fundamental objective of regulation. The importance of this point was recognized in a 1990 Commission paper on price cap regulation:

> In a competitive market, the price of a good is not determined by the productivity of any one firm, but rather by the productivity of all the firms in the sector. If any one firm achieves a higher level of productivity, then that firm will be able to keep the gains of that greater efficiency. Conversely a firm whose productivity lags that of its competitors will experience below average profitability. Thus, in a competitive industry consumer's experience price savings as a function of industry productivity, while firm's reap rewards or suffer penalties as a function of their own ability relative to their competitors.

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[3] W. Taylor and T. Tardiff, "Pacific Bell's Performance Under the New Regulatory Framework: An Economic Evaluation of the First Three Years," Testimony filed with the Public Utilities Commission of the State of California, April 8, 1993, Appendix 1, p. 12, Note 15.

[4] Factors other than achieved productivity growth have an impact on achieved earnings such that strong earnings results do not necessarily imply strong productivity growth.

> The price cap adjustment formula mimics the workings of a competitive market. The productivity factor reflects the expected difference between industry productivity and the productivity of the economy as a whole, which is reflected in the price adjustment. Just as in the competitive sector if the firm can exceed the productivity of its benchmark the price capped firm can also increase its profitability.[5]

Unless the structural characteristics of a firm, or groups of firms, are drastically different from the industry structure,[6] any sustained differences from long-term industry productivity growth would be the result of: (1) continued exceptional management performance of the firm; or (2) a sudden fundamental and long-term structural change that affects only a single firm. In the first case, an industry-wide productivity offset provides the proper incentives; the firm is rewarded for good management through sustained higher earnings until the industry catches up, or it experiences sustained poor earnings performance as a result of ill-advised management decisions until the firm can catch up with the industry. With regard to the second case, it is difficult to envision a fundamental structural change in telecommunications that would affect only a single firm.[7] Thus, an industry-wide LEC productivity index is the appropriate target for the LEC price cap plan.

C. One-Time Rate Reduction

In the Notice, the FCC states that it believes "there may be a good case for revising the 3.3 percent and 4.3 percent productivity factors, requiring a one-time reduction in rates, or both"[8] and, in Baseline Issue 3a, asks comment on whether a one-time change in the LECs' price cap index should be required. The effects of a one-time rate reduction on the firm are the same in the first year as implementing an equivalent increase in the productivity target; however, impacts in future years are significantly different. With a one-time rate reduction, rates initially drop to a new and lower level, but the cap continues to increase at the same rate as before. With an equivalent increase in the productivity offset, rates also drop to the same lower level as from an equivalent one-time rate reduction in the first year. In addition, the rate of change is also

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[5] "An Introduction to the Economics of Price Cap Regulation," Common Carrier Bureau, Federal Communications Commission, January 31, 1990, p. 14 (Economics of Price Caps).

[6] As may possibly be the case for some small LECs who may not have the same long-term productivity growth potential if they do not experience the same extent of economies of scale as larger LECs.

[7] This point refers only to sustained long-term differences in productivity growth. Differences experienced by a single firm as a result of, for example, a region-specific economic downturn (or rebound), or the impact of competition emerging at an accelerated rate, reflect short-term fluctuations, but not long-term structural differences. In addition, technological advances are likely adopted by all carriers as a result of competitive necessity since a competitive telecommunications environment requires all firms to keep up with, and surpass, industry developments. One can expect some variation among firms in how quickly they adopt new technologies, but these differences are short-term in nature and do not represent a fundamental long-term structural change for a single firm.

[8] NPRM, para. 45.

affected, resulting in a slower rate of growth in the price cap index for all future years the price cap formula is effective. However, neither of these alternatives is justified by either the LEC performance under price caps or the productivity evidence presented by Christensen.

LEC price and earnings data during the price cap period are fully consistent with the goals of the price cap plan and the Commission's expectations for earnings. Thus, price cap LEC earnings performance does not warrant either an increase in the productivity offset or a one-time reduction in rates. Both actions would have harmful effects on efficiency incentives and would represent a recapture of past productivity gains. This would diminish the LECs' incentives to undertake expensive and risky investments in technology and new product development, and runs counter to the efficiency goal of incentive regulation.

II. Measurement of Productivity

Productivity represents the overall economic efficiency in the production of output of a firm. Productivity growth can be broadly defined as the difference between the growth rates of output and input. The key elements used in productivity analysis are revenue, operating expense and capital. There are two fundamentally different approaches one might use in estimating productivity, generally classified as either direct or indirect methods of measurement. The direct approach utilizes company and industry financial and accounting data to compute the growth in the economic efficiency of production. The indirect approach emphasizes trends in either accounting costs per unit[9] or in the price of output relative to overall inflation.[10]

A. Indirect Productivity Measurement

Productivity growth leads to relative declines in costs and prices. Therefore, indirect productivity measurement approaches concentrate on measuring the difference between telecommunications output prices and U.S. inflation as a surrogate of the productivity differential between telecommunications and the overall economy. Such indirect studies of industry productivity focus on the comparison of the growth rates in two data series. The first series measures inflation and is intended to reflect the extent to which productivity in the overall

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[9] The Frentrup/Uretsky study is an indirect productivity study that analyzes LEC productivity in the post-divestiture period using data submitted by AT&T and USTA. Policy and Rules Concerning Rates for Dominant Carriers, 5 FCC Rcd. 6786 (1990) Second Report and Order, modified on recon., 6 FCC Rcd. 2637 (1991), Note 88 and Appendix C.

[10] The Spavins-Lande study attempts to confirm long-term estimates of local carrier productivity by examining the indirect productivity of the total telephone industry between 1928 and 1989 using a Consumer Price Index series. Id., Note 88 and Appendix D. W. J. Baumol and E. N. Wolfe, "Determination of the X Factor in the Price Cap Interstate Access: Steps Beyond the Spavins and Lande Study," AT&T Comments on Supplemental Notice of Proposed Rulemaking, Docket No. 87-313, Appendix E. This study extends the Spavins-Lande study by reweighting the output deflator to more closely coincide with the FCC's proposed capping mechanism and corrects the study for other statistical deficiencies.

economy has lessened overall inflation relative to the growth in overall input prices.[11] The second series measures industry-specific output price changes, using either a combination of Bureau of Labor Statistics price indexes[12] or an interstate access revenue per minute of use data series.[13] This type of output price measure is intended to reflect the net effect of productivity changes on industry prices. Thus, the difference between the change in U.S. inflation and the change in industry-specific output prices represents the differential between the telecommunications and U.S. productivity growth. The indirect approach does not establish any causal relationships between input and output measures.

While such indirect studies might have been useful in the past in collaborating direct and full total factor productivity (TFP) study results, their usefulness after the industry has operated for some time under a price cap environment is questionable. Using indirect studies as secondary evidence, based on comparing telecommunications price changes with some aggregate rate of inflation to derive productivity, made some sense before price cap regulation was implemented, for example, when initializing the productivity offset in moving from cost of service to price cap regulation. However, in an environment where price caps are already operating and are binding (i.e., prices cannot exceed the price cap limit) and earnings are constrained by a sharing mechanism, indirect measures become increasingly less useful in estimating telecommunications productivity and should be avoided by the Commission as an indicator of LEC productivity growth.

B. Direct TFP Measurement

The best way in which to measure productivity is to utilize direct and observable measures of inputs and output. This is accomplished by the direct total factor productivity approach, which defines the level of productivity as the ratio of output to an aggregation of all relevant factor inputs, all measured in real terms. Real outputs are generally measured by firm revenues adjusted for price changes, and real inputs by components of total operating expenses adjusted for inflation and return of capital.[14] Thus, TFP is a measure of the quantity of output per unit

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[11] Inflation measures used have included the GNP Implicit Price Deflator, the GNP Fixed Weight Price Deflator, and the Consumer Price Index.

[12] Studies have used various combinations of Telephone sub-indexes of both the Consumer Price Index and the Producer Price Index.

[13] Revenue per minute-of-use studies should be based on data that were adjusted to exclude the effects of exogenous cost changes (i.e., those costs which the FCC considers to be beyond the LEC's control, and which generally arise from regulatory or legislative action). Under price cap regulation, the PCI is adjusted to reflect exogenous cost changes, resulting in a reduction or increase in the price cap indexes, for an exogenous cost reduction or increase, respectively. As a result, unless the data are adjusted to exclude exogenous cost changes, revenue per-minute-of-use studies would inappropriately attribute the effects of exogenous cost changes to changes in the firm's productivity.

[14] A typical TFP model in telecommunications has four major components: (1) real output as measured by rate-adjusted revenues; (2) real capital input as measured by the opportunity cost of funds invested in telecommunications plant and equipment, i.e., economic depreciation and time value of money invested; (3) real labor input as measured by labor costs adjusted for inflation in wage, salary and other compensation and the mix of management and non-management employees; and (4)

of "aggregate" input.

TFP studies can be placed into two broad groups. First, annual index number studies directly compute the rate of productivity growth from data on output, capital, labor, and nonwage expenses. Factor payments are typically used as weights to construct aggregate input growth. Disaggregated measures of output are sometimes used, weighted by revenue shares.[15] These studies provide a decomposition of output growth into portions attributable to each input, and a residual which measures TFP growth. TFP captures: (1) technical change, i.e., producing a given level of output with less input (shifts in the production frontier); (2) economies of scale, scope and density, i.e., lower unit cost because demand is expanding in some way; and (3) other factors contributing to output growth not captured in the measured inputs. As a result, index number studies measure full TFP growth, regardless of the source of the unit production cost reduction.[16]

The second group of TFP studies, used in some academic literature, is econometric estimation of production (or cost) functions to isolate the effect of technical change on output growth (or cost reduction). Productivity estimates based on econometric estimation are more limited than full TFP measures based on index number computation, as explained below.

C. TFP Index Number Computation is the Proper Productivity Measurement

The productivity offset included in the price cap plan reflects the LECs' ability to reduce their unit cost of production at a faster rate than the overall economy. Therefore, the productivity offset must reflect all sources of unit production cost reductions. In a recent study, NERA mathematically shows that, given the structure of the annual price cap adjustment formula only TFP can be used to set the productivity target.[17] The only approach that properly captures efficiency gains from all sources is full TFP index number computation. Therefore, the Commission should adopt standard index number computation as the primary approach in estimating TFP. In addition, the productivity offset should be based on long-term industry-wide historical TFP studies, as discussed below.

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real nonwage expenses.

[15] Disaggregated measures of real output are constructed by adjusting billed revenues for rate changes. The percent changes in disaggregated real output are then weighted by average billed revenue shares to derive the percent changes in real output. This approach to weighting is known as the Törnqvist methodology. The U.S. Department of Labor, Bureau of Labor Statistics (BLS) and other respected productivity analysts (for example, Christensen Associates) use a Törnqvist index computation. See BLS, "Trends in Multifactor Productivity, 1948-81," Bulletin, Vol. 2178, September 1983, p. 52.

[16] For a discussion of index number comparisons, see Douglas W. Caves, Lauritis R. Christensen and W. Erwin Diewert, "The Economic Theory of Index Numbers and the Measurement of Input, Output, and Productivity," 50 ECONOMETRICA 1393 (1982).

[17] NERA, "Economic Performance of the LEC Price Cap Plan," Attachment to USTA Comments, CC Docket No. 94-1, filed May 9, 1994, p. 18.

TFP studies, such as the recent Christensen study, are preferred to econometric estimates, which are often sensitive to specification and hence too controversial to serve as the primary productivity measurement. This is a particularly important consideration in the context of price cap regulation because of the very different interests various constituents have with regard to the value of the productivity offset. Adoption of econometric estimation as the primary determinant of the productivity offset would likely entangle the Commission in lengthy debates over the very technical issues of proper model specification. Econometric estimation may, however, be useful as secondary evidence or in sensitivity analysis.

D. The Productivity Offset Should be Immune From Strategic Manipulation

The productivity offset is critically important to the success of the LEC price cap plan. It directly affects LEC financial viability and impacts the prices the LECs can charge their access customers. As a result, the different constituencies have different interests in the level of the productivity offset incorporated into the LEC price cap plan. The LECs are interested in achieving a productivity offset low enough to encourage investment and allow increased earnings when increased efficiencies are achieved. End user customers may hope to see a relatively high productivity offset if they believe it is necessary to increase overall downward pressure on LEC retail service prices. IXCs may wish to see a relatively large productivity offset if they believe it would reduce their input costs (LEC access charges constitute about 40 percent of the IXCs' input costs). CAPs and other LEC competitors may have an interest in keeping LEC rates high (i.e., a relatively low productivity offset) to provide them with potentially higher margins. Therefore, regulators must ensure that the productivity offset adopted for the LEC price cap plan is immune from strategic manipulation by the regulated firms and their competitors and customers, and that it is insulated from political manipulation. A necessary condition for achieving this is to base the offset on measurable external historical data using an accepted measurement approach. Also, the Commission should avoid adopting any "forecasting" of technological change on industry productivity, since any such forecast would be subjective and subject to strategic manipulation.

E. The Productivity Offset Should Reflect Long-term Productivity Results

The proper measurement of productivity requires the ability to distinguish long-term growth performance in total factor productivity from short-term fluctuations. There are several important reasons why long-term measures are more relevant in determining the LEC productivity offset. First, long-term productivity results will appropriately reflect the impacts of factors that lead to sustained effects of productivity growth, but do not include effects of factors that merely impact the level of productivity (thereby having only a temporary impact on productivity growth). Some productivity gains are sustainable into future periods, such as operational and technological changes that are diffused over multi-year implementation periods and result in repeated higher annual levels of productivity for a number of years. For example, development of a new switching software technology might lead to continued but small incremental improvements over a relatively long period of time as this technology is diffused, making possible the eventual phase-in of new services or a series of improvements in the provisioning of services. Such repeated annual productivity gains attributable to the diffusion of a specific technology appear and disappear only gradually as newer technologies are phased in and older technologies are phased out, and are reflected in long-term productivity trends.

However, not all productivity gains achieved in one period are sustainable into future periods. For example, if a company can drastically reduce its labor costs in one year through force reductions while maintaining revenues, then the measured annual productivity growth is temporarily increased and the level of the productivity measure rises to a higher level in the year the cost reduction takes place. This new productivity level could be maintained in subsequent years, but no significant additional productivity gains would result from the one-time force reduction. Conversely, a short-term drop in revenue, as a result of a regional economic downturn or natural disaster for example, may result in a temporary output reduction that is not matched by corresponding input cost reductions. This would result in a reduction in the level of productivity.

Since the productivity measure included in the price cap formula represents the rate of change in industry productivity over time, the measure of the level of productivity has to be converted to the rate of change in productivity. In doing so, a one-time increase or decrease in the level of the productivity measure (that results from a one-time reduction in the level of cost or revenue) is reflected as a temporary increase or decrease in productivity growth in the year of the cost/output reduction, followed in subsequent years by the productivity growth rate originally experienced before the one time cost or output reduction. As a result, the productivity offset included in the price cap formula should not reflect a one-time cost or output reduction that is not expected to reoccur, because the resulting temporarily higher or lower growth rate is not sustainable in subsequent years. To mitigate the impact of one-time events on annual TFP measures, the industry productivity offset should be based on a long-term productivity growth measure. The firm should be allowed to keep the financial rewards of actions which raise its TFP growth above the long-term industry TFP trend rate of growth. Conversely, the firm should absorb the downward pressure on earnings associated with temporary TFP growth reductions and find ways to become more efficient to "catch up." This is the primary goal of price cap regulation: to reward the firm for becoming more efficient.

This discussion points to the episodic nature of productivity. For example, productivity gains that result from diffusion of a particular technology will be replaced over time with the gains associated with the next wave of technological improvements. As productivity gains associated with the diffusion of older technology fade out, the gradual implementation of new technologies replaces the productivity gains of the older technology, potentially leaving the underlying trend rate of productivity growth unchanged. This means that productivity gains associated with the diffusion of future new technologies are already accounted for in the historical TFP measure, i.e., long-term TFP already includes the effects of the same types and magnitudes of technological diffusions that have occurred in the past. Thus, the episodic nature of productivity gains from technological change is appropriately reflected in a long-term TFP measure. Short-term productivity fluctuations, although unrelated to each other, are also episodic and add to the volatility of TFP measures. By adopting a long-term TFP measure, this volatility is mitigated and the episodic effects of short-term productivity changes are accounted for.

Second, telecommunications investments are typically "lumpy"; large investments may be required over a relatively short period of time to deploy new technology, followed by a period of relatively low investment, until the next enhancements require large capital outlays again at some later time. Such "lumpy" investment leads to productivity gains and spurts in investment that are subject to large fluctuations over relatively short periods of time. Short-term

productivity fluctuations are further intensified in capital intensive industries as a result of mismatches in the timing of input costs and output flows. Productivity enhancing decisions may often require several years to fully implement. Significant expenditures may be required in the early stages of the diffusion process (for example, there may be significant training expenses related to the new technology), but the benefits of that investment may not be realized for a number of years. This problem is particularly acute when the length of time necessary for capital investments to translate into productivity gains is approximately equal to or greater than the time period over which productivity performance is reviewed by the regulator. As a result, the timing of input costs may not be matched properly with the flow of outputs, causing the productivity measure to be somewhat understated in periods during which major expenditures take place, and somewhat overstated in later periods.

Another source of "lumpiness" in investment stems from regulatory mandates. Meeting regulated service quality standards or regulated deployment schedules may result in periodic faster nondiscretionary investment than is optimal in a business environment absent the regulatory mandate.

Third, short-term fluctuations in national, regional and local economies, as well as unusual events, such as natural disasters, are major sources of volatility in achieved productivity. Such short-term effects are not permanently sustainable and should not affect the productivity target selected in price cap regulation.

Fourth, productivity is procyclical because some factors, such as capital and skilled labor, are not fully variable.[18] For example, in times of economic contraction, a firm cannot reduce its skilled labor force instantaneously with declining output because termination of highly skilled workers is especially costly. The firm will tend to keep its skilled labor force when it expects a subsequent economic rebound because of the high cost of reacquiring and training skilled labor. Conversely, in times of economic expansion, the firm will delay or avoid hiring additional skilled labor, if possible, if it considers the expansion to be short lived or until overtime is no longer economical. This procyclical nature of productivity introduces further volatility into any productivity measure.

F. The Productivity Measure Must be Smoothed Over Time

The above factors all contribute to short-term fluctuations in productivity measures. This volatility is not unique to the telecommunications industry. For example, the railroad industry exhibited significant volatility in annual industry productivity growth with a high of 17.6 percent in 1987 and a low of -8.8 percent in 1991.[19] Thus, observed productivity growth must be smoothed over time to minimize the effects of these temporal fluctuations and to arrive at the underlying long-term productivity growth experienced by the industry. A number of smoothing

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[18] For example, see William J. Baumol, Sue Anne Batey Blackman, and Edward N. Wolfe, Productivity and American Leadership: The Long View, MIT PRESS (1989), p. 66.

[19] Productivity Adjustment-Implementation, 9 I.C.C.2d 1072, 1074 (1993). Railroad productivity growth for 1982-1991 was as follows: -4%, 10.2%, 6.4%, -1.8%, -2.2%, 17.6%, 5%, 6%, 5.6%, and -8.8%.

techniques are available, including arithmetic or geometric averaging of the data over some number of years, or by employing some other approach to smooth cyclical fluctuations.

Ideally, the averaging period should encompass at least an entire business cycle to include productivity from both up and down years in the productivity measure, at least to initiate the measure. This may not always be feasible even in the beginning, and will certainly not be possible for subsequent years because business cycles do not exhibit identical patterns, i.e., they differ in severity and duration. A floating averaging period tied to business cycles of varying lengths would be difficult to implement because the end of a business cycle cannot be determined until some time after the cycle is complete, introducing additional delay in computing such a floating averaging measure.

A more appropriate method to adopt is a fixed-length "rolling average," which cuts off the oldest year's data and adds a more recent year. These two affected years will not necessarily be reflective of the same stage of a business cycle, but over time, each year's productivity change will be fully reflected in the smoothed productivity measure. Under a rolling averaging technique, for example over ten years, the productivity gains of any given year are incorporated in the index as one tenth of that growth in each of the ten years of the averaging period. Stated another way, the productivity index for a given year reflects one tenth (assuming a ten year moving average) of the productivity gains achieved in each of the ten years included in the averaging period. Thus, the productivity results experienced in one year are fully accounted for in the moving average index, but the impacts of short-term fluctuations are spread over a number of years, and thus, minimized in any one year.

G. Technical and Practical Considerations

There are several technical and practical considerations that must be considered in developing an appropriate TFP index, including proper measurement of capital input and labor and data consistency across firms and over time.

1. Proper Measurement of Capital Input

The telecommunications industry is capital intensive. LECs have made substantial investments in developing the public switched network, providing service to all parts of their service territories regardless of the high capital costs of serving remote areas. The LECs undertook these high capital outlays as part of their obligation to service, readiness to serve, and carrier-of-last-resort obligations. At the same time, regulatory policies established accounting depreciation rules which tended to adopt depreciation lives that were considerably longer than the useful lives of these investments in light of the rapid advances in the technologies underlying switching and transmission equipment.[20] Thus, accounting depreciation refers to the depreciation proscribed by the FCC and other regulatory bodies, whereas economic depreciation refers to depreciation based on the useful lives of investments.

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[20] C. R. Hulten, The Measurement of Capital, in FIFTY YEARS OF ECONOMIC MEASUREMENT 119 (E. R. Berndt and J. E. Triplett eds., 1990). This article reviews the major methods for measuring capital.

In general, accounting depreciation has reduced the level of total LEC operating expenses and revenue requirements below the levels suggested by economic depreciation studies, resulting in lower rates and contributing to inefficient network utilization (because prices do not reflect the economic costs of the service). The proper measurement of TFP requires the use of economic depreciation in the development of the real cost of capital inputs.

Accounting and economic approaches to capital measurement both begin with the telephone plant accounts, summarized in a LEC balance sheet by gross book value and accumulated depreciation. The two approaches differ in how the real cost associated with the use of telephone plant is derived from accounting records. Accounting approaches typically rely on book depreciation, possibly adjusted for inflation, to measure capital input. In contrast, economic depreciation-based approaches reflect an engineering analysis of the assets; they measure the magnitude of the constant dollar factor payment to capital by combining information about the replacement cost of assets in a base year, the age of assets by category, price and efficiency indexes[21] of each category, and annual investment. As a result, economic depreciation approaches recognize both the influence of declining efficiency and the emergence of new technologies in the determination of the depreciation estimate and more accurately reflect the useful or economic lives of investments. Thus, economic depreciation-based approaches result in a measure of constant dollar capital input cost which can be combined with measures of constant dollar labor and intermediate input costs through a Törnqvist weighting to derive an index of input growth.

In addition, the use of economic depreciation approaches in TFP studies has the added advantage of minimizing distortions in historical results which otherwise might have been caused by changing depreciation policies. Finally, studies that fail to adjust for the discrepancy between accounting and economic depreciation will tend to overstate productivity growth because they understate both the weighting of capital in the determination of aggregate input and changes in the real cost of capital inputs.

2. Proper Measurement of Labor Inputs

Labor represents a significant input cost in the measurement of productivity. There are several different ways in which labor costs could be measured. Several of these, such as use of hours worked without any further adjustments, are not appropriate for telecommunications because they do not properly reflect changes in the composition of the work force. Over the past several years, many of the LECs have undergone significant downsizing to adapt to a new competitive environment and to operate most efficiently. For example, the Regional Holding Companies have reduced their work force by 3.8 percent annually since 1984,[22] while SWBT's work force declined at an annual compound rate of 4.5 percent during that time. However, downsizing does not necessarily affect management and nonmanagement employees equally, resulting in changing shares of management and nonmanagement employees over time. For SWBT, management jobs

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[21] The efficiency index used in the economic depreciation approach is not equivalent to or a proxy of any variant of accounting depreciation expense as defined by current FCC or IRS regulations.

[22] This calculation is based on employment data provided by "Statistics of the Local Exchange Carriers For the Year 1992," USTA, p. 3.

declined by an average of 6.1 percent a year since divestiture, compared to an average decline of 3.9 percent a year for nonmanagement jobs. Thus, while wages have been declining overall in recent years, the managerial component of labor costs has been declining relatively faster, resulting in a lower share of labor input costs for management employees. Failure to include the effects of this shift on TFP would understate the reduction in labor inputs, thereby understating TFP growth.

The appropriate approach for computation of the TFP labor input component consists of a three step process. First, compensation indexes are developed for management and nonmanagement workers. The managerial compensation index consists of the ratio of average management salary to average salary per employee, the nonmanagement compensation index consists of the ratio of average nonmanagement salary to average salary per employee. Second, these compensation indexes are applied to the hours worked for each employee type to compute an aggregate "hours worked" index. The final step is computation of constant dollar labor input as the product of the base year total compensation and the current year aggregate "hours worked" index. This standard approach incorporates shifts in the relative shares of management and nonmanagement workers.

III. Effects of Pro-Competitive Regulatory Initiatives on Productivity

One of the fundamental goals underlying Commission action in recent years has been to foster competition for telecommunications services to the greatest extent possible. While the Commission has been successful in transitioning some services, including long distance, to a competitive environment with streamlined regulation for many of the incumbent provider's services, the LECs continue to carry the burdens of extensive past and present regulatory constraints even though they face considerable competition in many of their major markets. As a result, the aggregate productivity growth of the firms which currently comprise the price cap LECs is likely to be lower than recent historical experience. The remainder of this section explains several factors which contribute to this expected decline in LEC productivity growth as the industry transitions to a competitive structure.

A. Effects of Competition on Productivity

One of the most important factors effecting LEC productivity growth is the increased competition faced by LECs in all major business segments. It is often presumed that industry productivity increases as competition is introduced in a market. In fact, the positive anticipation of ever increasing competition, coupled with marginally improved regulatory efficiency incentives, has already led the LECs to become leaner in their operations. This is one factor why competition is not likely to have a large initial stimulus to LEC TFP growth.

More significantly, productivity effects of increased competition will likely be different for incumbent firms than for new entrants. Policies and technological advancements that facilitate competitive entry result in competitive losses to incumbent firms in high-margin, high-density metropolitan markets. These markets are subject to considerable economies of density, defined as technological efficiencies which result from an increase in the volume of services within a specific service area. Thus, greater efficiencies that can be achieved as the concentration of the number of customers per square mile increases, can be attributed to economies of density.

Empirical evidence indicates that economies of density were an important part of the productivity growth of the pre-divestiture Bell system.[23] It is not clear, however, whether these pre-divestiture economies of density can be sustained in a competitive environment since entry occurs first in high-volume, dense urban areas. The Commission acknowledged this in a recent Staff Working Paper, which states: "[O]ne challenge may be that competitive service areas tend to be the dense metropolitan areas in which the LECs have deployed network facilities that enable significant productivity gains."[24] As the LEC loses customers in these dense metropolitan areas, it also loses some of the economies of density previously achieved in those areas, resulting in productivity decreases for the incumbent firm.

New entrants[25] are attracted to large urban areas because the LECs' tariffed prices have been geographically averaged. Thus, contribution margins have been highest in high-volume, low-cost markets. But unlike their competitors, the LECs are required to file and adhere to tariffs and other regulatory requirements, which preclude them from pricing their services based on economic cost and market conditions.[26] As the Commission staff recognized, "LECs' competitors have incentives to enter only the markets that have historically provided the funding for assistance and contribution flows, namely, high volume business users in metropolitan areas where LEC rates have traditionally been higher than their costs."[27] Such higher margins provide the financial incentives for competitors to enter the market, resulting in increasing revenue losses to incumbent firms. This is reflected as reduced LEC output and slower LEC productivity growth. This is so because it is difficult, if not impossible, to reduce costs at the pace that customers are lost to competitors.

In order for incumbent price cap LECs to not experience a decline in productivity as a result of competitive entry, input costs would have to decrease at a pace at least equal to the pace by which output decreased. This would only be the case if LEC investments were completely fungible and could immediately be put to alternate use. Clearly, this is not the case in

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[23] D. W. Caves and L. R. Christensen, "The Importance of Economies of Scale, Capacity Utilization, and Density in Explaining Interindustry Differences in Productivity Growth," 24 LOGISTICS & TRANSP. REV. 26 (Spring 1984).

[24] Access Reform Task Force, "Federal Perspectives on Access Charge Reform: A Staff Analysis," April 30, 1993, p. 51 (Staff Analysis).

[25] A new market entrant, in this context, refers to either a firm selling the product or service, or internalization of the telecommunications functions by a customer.

[26] New market entrants are usually not constrained by numerous regulatory requirements which apply to incumbent LECs, such as (1) geographic rate averaging requirements; (2) public policy decisions which have established prices that are not based on economic cost; (3) prohibitions against pricing on an individual contract basis; (4) outdated rate structures; (5) prohibitions against repackaging services in response to customer requests; and (6) a protracted waiver and appeals process.

[27] Staff Analysis, p. 54. The downward TFP impact from this course of events is likely to be magnified by cutting price (if allowed) to minimize market share loss, coupled with aggressive capital investment programs to more closely align the LECs' technological profile in competitive market areas to that of the CAPs.

telecommunications because the provision of exchange access services is capital intensive, with relatively high fixed input costs. These fixed costs remain part of the LECs' input costs even after a substantial share of revenue is lost to competition. Thus, the reductions in LEC output that result from competitive losses will likely be substantially greater than the accompanying cost reductions, leading to lower LEC productivity results.[28] Losing large customers to competition may well lead to lower LEC productivity growth over a number of years, compared to the historical industry average reflected in the LEC price cap plan. As the Christensen study states: "with increasing competition in their markets, [the LECs] face the prospect of even slower output growth. Because the provision of local exchange services is characterized by economies of density, these reductions in output growth will lead to reductions in LEC TFP growth."[29]

B. Competitive Services Must be Removed from Price Cap Regulation

It has long been recognized that effective competition provides the greatest economic benefits,[30] and one of the FCC's objectives in recent years has been to foster competition wherever possible. In fact, the main purpose of regulation is to replicate competitive market forces when prevailing market forces cannot be relied upon to achieve this. In competitive markets, the market will regulate price, and price regulation is no longer needed as a substitute for competition or to protect consumers.[31] The Commission arrived at these same conclusions in its assessment of competition in the long distance market, where it found that advance scrutiny of most AT&T business service tariffs was no longer necessary to protect the public interest, given the competitiveness of the business services market and the fact that none of the prices of these competitive services have been at or above the upper rate band allowed under price caps, such that price caps were no longer a necessary constraint on AT&T's pricing of the most

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[28] Costs may actually increase modestly in response to new competition (and not decline) as marketing efforts are expanded in the competitive environment.

[29] Christensen Study, p. 13.

[30] As the FCC explains: "The Commission has long recognized that in effectively competitive markets, market forces can best further the goals of the Communications Act of efficient telecommunications services provided through adequate facilities at reasonable prices. The reason is quite simple: competitive forces best allocate society's resources, encourage innovation and efficiencies, and generally maximize benefits to consumers. Indeed, while limited government regulation of functionally competitive markets may sometimes be appropriate to further important social goals, such as universal service, unduly strict regulation of rates in competitive markets is generally not only superfluous, but harmful to the public interest." Competition in the Interexchange Marketplace, Notice of Proposed Rulemaking, 5 FCC Rcd. 2627 (1990), para. 97.

[31] The market-based price ceiling caused by competitive price responses will limit any firm, including the LECs, from charging an unreasonably high price for any length of time, because customers will simply switch to and purchase from the lower priced competitive providers. Tariff filing and other requirements associated with price cap regulation, such as service categories and banding restrictions, average pricing requirements, as well as the backstop sharing mechanism, are overly restrictive and impose an undue competitive disadvantage on the LECs in those markets where the LECs face effective competition because they preclude the LECs from timely and effective price and service responses to changing market conditions.

competitively provided business services.[32] The Commission also found that the tariff filing requirements of such unnecessary price cap regulation impose both direct and indirect costs on users.[33]

Based on these conclusions, the Commission allowed AT&T to remove the services found to be competitive from price cap regulation and offer them under streamlined regulation. Correspondingly similar criteria should be applied to LEC access markets. LEC services in markets where competition exists should be removed from price cap regulation. Thus, an appropriately designed price cap paradigm includes provisions for the identification of competitive services and their removal from price cap regulation. Removal of competitive services from price cap regulation, however, raises a number of implementation issues, not the least of which relates to the determination of the proper productivity offset for the less competitive services remaining under price cap regulation.

C. Productivity and a Competitive Environment

Without a doubt, a major source of future productivity growth will come from continued implementation of state-of-the-art technology, and from the new services that will be made possible by it, just as it has in the past. These new services will likely be offered competitively with other providers and thus, are part of the competitive services that would be offered outside price cap regulation. Future productivity gains from the remaining price cap services, on the other hand, will likely tend to be smaller since these services represent basic, established core services using existing technology. The price capped services will likely benefit to some extent, at a minimum as a by-product, from technology development and diffusion driving the new and competitive services. However, core service productivity gains will likely be substantially lower than the achieved industry-wide historical productivity growth upon which the price cap productivity offset is based, and which reflects the effects of tremendous productivity gains made possible by the introduction of technological advances.

A key concern associated with removal of competitive services from price cap regulation is the LECs' inability to achieve, from its remaining regulated services, the level of productivity implied in the price cap productivity offset. This will likely impose ever increasing downward pressure on regulated service prices, unaccompanied by the productivity achievements this is to reflect, and LECs may find it increasingly difficult to profitably offer their regulated services.

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[32] Competition in the Interstate Interexchange Marketplace, Report and Order, 6 FCC Rcd. 5880 (1991), paras. 73-76.

[33] The Commission's list of direct costs included delaying the availability of new services and price reductions as well as regulatory uncertainty. The main source of indirect costs found by the Commission was the distortion of the competitive process that would (1) deny AT&T the full pricing flexibility needed to react to market conditions and customer demands, thereby diminishing its ability to compete as full-fledged competitor; (2) reduce the value of AT&T's service offerings by creating regulatory delays and uncertainty; (3) foster a reactive market, rather than a proactive market by giving AT&T's competitors advance notice of price and service changes; and (4) lessen AT&T's incentive to initiate pro-consumer price and service changes by precluding AT&T from being a "first-mover" in the market. See id., paras. 78-90.

Achievement of an industry-wide productivity offset from the price caps core services will become increasingly more challenging for the LECs in the new competitive environment.

Finally, productivity gains achieved by competitive services cannot somehow "make up" or offset the productivity shortcomings from price cap regulated services because the productivity offset only applies to services remaining in price cap regulation. As discussed above, losing large customers to competition will likely lead to lower LEC overall productivity growth over the next several years, compared to the historical industry average reflected in the LEC price cap plan. Thus, the existing LEC productivity target represents a significant stretch for the LECs during the coming years of transition to full competition.

IV. Effects of Technological Change

There is no doubt that technological progress will profoundly affect the telecommunications industry and provide customer benefits during the next decade. The LECs' historical record of integrating innovations into their operations is evidenced by the fact that average telecommunications productivity growth exceeds comparable national measures. While this historical productivity differential is reflected in the current productivity offset, several observers have suggested that the productivity offset should be increased. These parties assert that this country is embarking on a telecommunications technology "revolution," resulting in unprecedented leaps in technological innovation and an explosion in the demand for telecommunications-based services, and leading to substantial and unprecedented gains in telecommunications productivity. Although these assertions sound appealing on the surface, they reflect self-serving rhetoric and do not stand up to basic scrutiny. In addition, these advocates ignore the fundamental changes in the structure of all aspects of the LECs' business that may well cause future LEC productivity growth to be lower than historical experiences.

The primary flaw underlying the "technology revolution" argument appears to be a misconception about the timing of events, i.e., about when innovations and technological advances are developed as opposed to when and how these advances actually become implemented within a LEC's operations. Technological change affects productivity, but it does so only as it is diffused throughout the industry. A clear distinction needs to be made between the rate of technological advances and how these advances actually change system-wide costs. A "technology revolution" may well be taking place, with technology changing by leaps and bounds. However, technological change affects TFP only by how important the change is to overall production and by how quickly it is diffused throughout markets.

This diffusion process does not happen abruptly, but rather it takes place smoothly over extended periods of time. Decisions on diffusion are guided by marginal decisions, where it just makes economic sense to implement the new technology. These decisions are made at the central office and switch levels, not globally for all central offices or switches at one time. Furthermore, it is often not even necessary to replace an entire switch. Upgrades are often made by adding software to the existing switch, or changing out pieces of the switch when the marginal cost difference is small enough to warrant implementing the change. Thus, while the underlying change in technology may be large, it is implemented in small increments over many years. TFP will capture these changes as they occur throughout markets, and as prices reflect the diffusion process. This is supported by a recent study of narrowband, wideband, and broadband

digital communications developments by Technology Futures, Inc. The study states:

> The impact of new digital services on the telephone network will be dramatic, as vast amounts of existing equipment are made obsolete. An industry accustomed to equipment lasting decades must now accustom itself to much shorter equipment lives based on economic value in a competitive business. However, the network will not change overnight. According to our forecasts, the transformation of today's telephone network to the ultimate network of the future (according to today's vision) will take decades. This is a reflection not only of the size of the job of conversion, but also of the rate at which demand will develop, economic realities, the willingness of customers to pay, technical uncertainties, regulatory constraints, and the inertia within the industry itself. All of these factors make likely a series of evolutionary improvements that will transform the network economically, while still meeting the needs of customers [emphasis in original].[34]

A second consideration overlooked by the "technology revolution" advocates is historical precedence. For example, the development of fiber optic transmission in the early 1970s represented a technological break-through, a "technology revolution." Yet, it took almost two decades for this new technology to be widely deployed. Productivity gains from fiber optic technology were realized gradually and smoothly over time, in step with actual deployment of this new technology. Fiber optics is not an isolated example. There have been a number of dramatic technological break-throughs in the past,[35] all with the same result: actual changes in industry costs happened smoothly over time as a result of the diffusion process, and the impact of technological change, even a "technology revolution," is reflected in the historical TFP results. There is no reason to expect future technology to be absorbed more quickly within the industry.

Finally, forecasting changes in the long-term rate of technological diffusion with the kind of accuracy that would be required for adopting it as the basis for the productivity offset would be extremely difficult, if not impossible, and very contentious. Most importantly, there is no basis for expecting an accelerated rate of technological diffusion than what is already captured by a historical TFP measure and, thus, no basis for requiring such forecasts. The Commission should not attempt to pursue any such proposals.

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[34] Lawrence K. Vanston, "New Telecommunications Services and the Public Telephone Network," published by TECHNOLOGY FUTURES, INC. as volume seven of a larger study entitled "New Telecommunications Services for Business and Society, 1990-2010," 1993, p. 4.

[35] Other technology break-throughs include: direct-dial service, one-plus dialing, touch tone, custom calling, voice mail, automated attendant/caller routing, 800 services, digital switching, cellular radio, facsimile, electronic mail, electronic funds transfer, electronic data interexchange, etc.

Summary of Exogenus Adjustments
1991-93

The net effect of exogenous adjustments have been significant reductions in the LECs' price caps.

Exogenous Cost Changes	1991-93 Amount
Reserve Deficiency Amortization Part 61.45(d)(1)(i)	($455M)
Changes in Accounting Rules Part 61.45(d)(1)(ii)	$199M
Changes in Separations Rules* Part 61.45(d)(1)(iii)	($651M)
Changes in LTS and TRS Part 61.45(d)(1)(iv)	$106M
Reallocation of Regulated Investment Part 61.45(d)(1)(v)	($0.1M)
Tax Law Changes Part 61.45(d)(1)(vi)	$172M
Other Extraordinary Cost Changes Part 61.45(d)(1)(vi)	$65M
Inside Wire Amortization Part 61.45(d)(1)(viii)	($166M)
Total	**($730M)**

* Exogenous treatment of SFAS-106, under an accounting order.

GNP-PI VERSUS GDP-PI: 1982 TO PRESENT

QUARTER	GNP-PI	GDP-PI	DIFFERENCE
1982 Q1	83.5	83.4	-0.1
1982 Q2	84.3	84.3	0
1982 Q3	85.4	85.4	0
1982 Q4	86.3	86.3	0
1983 Q1	87.0	87.0	0
1983 Q2	87.7	87.7	0
1983 Q3	88.5	88.5	0
1983 Q4	89.3	89.3	0
1984 Q1	90.1	90.0	-0.1
1984 Q2	90.7	90.6	-0.1
1984 Q3	91.5	91.4	-0.1
1984 Q4	92.3	92.3	0
1985 Q1	93.2	93.2	0
1985 Q2	93.9	93.9	0
1985 Q3	94.6	94.6	0
1985 Q4	95.5	95.5	0
1986 Q1	96.1	96.0	-0.1
1986 Q2	96.6	96.6	0
1986 Q3	97.3	97.3	0
1986 Q4	98.0	98.0	0
1987 Q1	98.9	98.9	0
1987 Q2	99.5	99.5	0
1987 Q3	100.3	100.4	0.1
1987 Q4	101.3	101.3	0
1988 Q1	102.2	102.2	0
1988 Q2	103.3	103.3	0
1988 Q3	104.7	104.7	0
1988 Q4	105.6	105.6	0
1989 Q1	106.9	106.9	0
1989 Q2	108.2	108.2	0
1989 Q3	109.2	109.2	0
1989 Q4	110.2	110.2	0
1990 Q1	111.7	111.7	0
1990 Q2	112.9	112.9	0
1990 Q3	114.3	114.3	0
1990 Q4	115.3	115.3	0
1991 Q1	116.7	116.8	0.1
1991 Q2	117.7	117.8	0.1
1991 Q3	118.7	118.7	0
1991 Q4	119.5	119.5	0
1992 Q1	120.7	120.8	0.1
1992 Q2	121.7	121.8	0.1
1992 Q3	122.5	122.5	0
1992 Q4	123.4	123.5	0.1
1993 Q1	124.7	124.8	0.1
1993 Q2	125.6	125.6	0
1993 Q3	126.2	126.3	0.1
1993 Q4	126.9	127.0	0.1
Average Annual Growth			
1982 Q1 - 1993 Q4	3.63%	3.64%	0.01%
1989 Q4 - 1993 Q4	3.59%	3.61%	0.02%
1992 Q4 - 1993 Q4	2.84%	2.83%	-0.01%

Sampling of Recent LEC Part 69 Waiver Requests to Establish New Rate Elements

Listed below are examples of LEC new services where the Commission's rules required that the LECs file and obtain approval for waiver requests before LECs would be allowed to establish effective tariffs.

Information Surcharge Rate Element

On December 3, 1990, Southwestern Bell requested a waiver of Part 69 of the Commission's Rules to permit the establishment of an Information Surcharge Rate Element within the Information category to recover certain costs associated with the publication of white pages. The waiver was approved, ten months later, on October 9, 1991. See Southwestern Bell Telephone Company Petition for Waiver of Part 69 of the Commission's Rules for Information Surcharge Element, Order, Released October 9, 1991.

Electronic White Pages

On May 18, 1990, U S WEST filed a petition for waiver of Part 69 of the Commission's rules to establish a new rate element and new subelements in the Information Element for its new Electronic White Pages service. The waiver request was granted by the Commission four months later on September 14, 1990.

On July 10, 1990, The New York Telephone Company and New England Telephone and Telegraph Company (NYNEX) filed a petition for waiver of Part 69 of the Commission's Rules to establish new rate elements for Electronic White Pages. Four months later, on November 27, 1990, the Commission granted the request.

On September 28, 1990, Cincinnati Bell Telephone Company (CBT) filed a Petition for Waiver of Part 69 of the Commission's Rules to establish a new Switched Access rate subelement in the Information element category of a proposed Electronic White Pages service. The waiver was approved five months later, on February 19, 1991. See Petition for Waiver of Part 69 of the Commission's Rules for Electronic Directory Assistance Service, Order, Released February 19, 1991.

Common Channel Signalling

On January 31, 1991, fourteen months following the filing, the Commission denied the Ameritech Operating Companies' request for a waiver of Sections(s) 69.4(b), 69.206, and Subparts B, D and E of Part 69 of the Commission's rules to permit the unbundling of charges for the port that would be utilized by parties desiring access to the Companies' Signaling System 7 network. Such unbundling would have permitted the Companies to assess certain charges only on those end users causing the costs to be incurred.

On June 11, 1990, Southwestern Bell Telephone Company (SWBT) filed a petition for waiver of Part 69 of the Commission's rules to establish a new switched access rate element for its common channel signalling (CCS) interconnection service. On June 14, 1990, SWBT filed a petition for waiver of Part 69 to establish two new switched access rate elements for access to the data in SWBT's line identification database (LIDB). Sixteen months later, on October 4, 1991, the Commission conditionally granted the requested waivers. See Southwestern Bell Telephone Company Petitions for Waiver of Part 69 of the Commission's Rules, Memorandum Opinion and Order, Released October 4, 1991.

Operator Services

On October 12, 1989, Southwestern Bell filed a petition for waiver of Part 69 of the Commission's rules to establish separate rate elements for operator services provided to interexchange carriers (including 0- transfers). Seven months later, on May 31, 1990, the Commission granted the requested waiver.

On February 6, 1990, the Ameritech Operating Companies (Ameritech) filed a petition for waiver of Section 69.4(b) of the Commission's rules in order to establish separate rate elements for operator transfer services for its interexchange carrier (IXC) access customers. On March 5, 1991, thirteen months later, the waiver was granted. See Ameritech Operating Companies Petition for Waiver of Section 69.4(b) of the Commission's Rules, Memorandum Opinion and Order, Released March 5, 1991.

On January 29, 1990, NYNEX filed a petition for waiver of Section 69.4 of the Commission's rules to establish separate rate elements for Busy Line Verification and Busy Line Verification/Interrupt services. On March 5, 1991, thirteen months later, the waiver was

conditionally granted. See New York Telephone Company and New England Telephone and Telegraph Company Petition for Waiver of Section 69.4(b) of the Commission's Rules, Order, Released March 5, 1991.

Switched 56 KBPS Service

On May 18, 1990, Rochester Telephone Company filed a petition seeking a waiver of Section 69.4(b) of the Commission's Rules to permit Rochester to offer interstate switched 56 KBPS digital service. Four months later, on September 14, 1990, the Commission granted the waiver request.

Optional Switched Access Package with Volume Discount

On August 21, 1987, GTE filed a petition for waiver to establish elements for a new optional switched access plan called PSA. PSA was designed to complement high-volume unbundled interexchange services such as Megacom. It incorporated volume and time-of-day discounts, and offered switching, routing, and billing features tailored to the needs of high-volume customers. On August 2, 1988, twelve months later, the petition was denied.

New Technologies and Services Structure Issues
New Services Will Present Regulatory Challenges

As a result of changes in technologies and services and in the Commission's policies for access services since the inception of the access charge plan in 1983, the plan has become outdated. In reforming the access charge plan, regulators must ensure that it is dynamic and flexible so that it does not once again become outdated.

Encouraging the introduction of new services and technologies is a stated objective of the Commission. Rapid changes in technology are making possible the development of a wide range of new access services. However, the existing framework of access rules impedes the development and introduction of these new services. Because the existing rate structure rules are prescriptive, they must be waived or changed to introduce new elements. As demonstrated in Appendix A, this traditionally has been a protracted process.

The incompatibility of the rules with new services goes beyond the waiver process. Waivers have been delayed in part because the access structure itself is too rigid, and new services do not fit logically into the structure. Each waiver petition is centered around issues of service classification or consistency with the existing structure. As new services differ more and more from the 1983 technology embedded in the rules, customers will increasingly be frustrated in obtaining the telecommunications services they desire.

New services which provide private line functions using shared, switched resources under software control will appear to be "switched" services under current definitions. However, the rate structures prescribed for the current switched services may be incompatible with these offerings. The switched access rules also provide only for two-point service, while some offerings will involve multipoint bridging arrangements. Some new services will provide both dedicated bandwidth, like today's special access services, and usage-based functions similar to today's switched access, on an integrated basis. These services "straddle" the current switched and special categories; yet, depending on which category they are placed in, very different cost allocation and pricing requirements would apply. Current rules also make it difficult to interconnect switched and special services. This has led to limitations in the arrangements customers could establish using new integrated services. Other services are simply not addressed

in the current structure.

Assumptions built into the existing rules may also result in rates for some new services which are severely distorted from the level a market outcome would produce, therefore discouraging LECs from proposing such services. Current rules for switched services, for example, call for rates to be based on relative usage or equivalent voice grade channel capacity. True market outcome would result in a service offered in a different rate structure (e.g., flat-rated structure).

The rules also limit customers' ability to request and receive new service packages which meet their particular needs, and which are competitively priced. As AT&T has shown with its optional calling plans, such packages can significantly expand the range of choices available to customers. They can also be vehicles for introducing more efficient, non-uniform pricing structures. However, the difficulty of obtaining waivers for new rate elements, the requirement for study area averaging, and the Commission's past unwillingness to permit volume discounts for switched access services, forestall the development of new package options.

Telecommunications customers increasingly demand expanded capabilities: from voice communications to transmission and processing of information (i.e., voice, data, image) among terminals and databases; from providing transport services to providing network capabilities; from standardized services to market or customer specific offerings; from carrier control to customer control; from local to global services. User-switched, two-way fully interactive video conferencing networks are replacing video-tape production and one-way visual communication in the business, education, and government market sectors. While telephone companies, cable systems and other service providers seek to meet these market demands, regulatory rules, as opposed to customer choice, dictate which providers will prevail and what services will be offered. This precludes effective competition.

Following is a list of major new services considered for introduction in the next decade by the telecommunications industry, including a brief description of how the current rules conflict with implementing these new services:

Customer Service - a set of inbound telemarketing capabilities which enable a telemarketer to display the calling customer's client information, and perform interactive call routing, selective call treatment and network-to-user signaling.

These new switched access offerings could be built on new or restructured basic service elements (BSEs), which would require FCC waivers. A new BSE must be approved under the process outlined in Part 69.119 of the Commission's rules prior to a tariff filing.

Transaction Processing - on line information processing supporting standard business transactions like credit card authorization and Automatic Teller Machine transactions.

This service may include dedicated connections to a data base such as the Line Information Database (LIDB) and may include a look-up in the data base.

Switched High Speed Service - a switched n x 1.544 Mbps service in support of point to point and point-to-multipoint transmission.

The switching arrangement may be considered switched access, and if so, a Part 69 waiver will be required to establish rate elements. In addition, while the Commission's policies have historically required usage based rate elements for switched services, switched high speed service may more appropriately be offered on a flat rate or some other basis. The current rules do not currently provide for serving arrangements which combine a switched service with existing special access services.

Switched Multi-megabit Digital Service (SMDS) - a high speed public packet service which provides local area network-like performance and features over a wide area.

Packet Service is not addressed in Part 69 Rules. As a switched service, waivers of local switching and switched transport (Rules 69.106, 69.111 and 69.112) may be required. This service raises issues similar to those raised by switched high speed service.

Switched Fractionalized 1.544 Mbps Service - includes Non-ISDN switched 1.536 Mbps service, ISDN switched .384/1.536 Mbps service, and ISDN n x 64 fractional 1.544 Mbps service.

Averaged rates, based on previous cost allocations, for existing elements (e.g. channel terminations) may not be consistent with market prices for these newer services. Competitive rates may be prohibited without waivers. The classification of these services between the current switched and special categories is also not clear.